Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

ON THE CONSTRUCTION OF CROMLECHS, CALLED IN THE NORTH OF EUROPE "GIANTS' CHAMBERS."

By His Majesty King Frederick VII. of Denmark.*

[Read at the Annual Meeting of the Society of Northern Antiquaries, held at Christiansborg, May, 1857.]

At the last annual meeting held in our palace by the Society of Northern Antiquaries, the qnestion was once more raised—how did our ancestors, living during the " Stone Period," and unassisted by mechanical means such as we now possess, contrive to move those great masses of stone which form their sepulchral chambers, usually called those of the" Giants;" and more especially, what method did they adopt for lifting to their seats the enormous stones which serve to form the roof of those chambers?

It is now several years since I offered my opinion on this subject;—at the annual meeting of the Society in 1853. But I regarded this opinion at that time only as a first attempt to explain what must have astonished every one: and I was aware that the proposed explanation required a much further development. It is for this reason that I have employed some leisure hours in reverting to the same subject, which I have considered from several different points of view, and of which perhaps I can now give a fuller and more correct explanation.

In my first attempt I limited myself to the elucidation of this single point:—how the men of the " stone period" were capable of raising the huge over-lying stones up to the height of the sepulchral chamber. In the following pages I shall give my opinion as to the construction of the entire chamber. I shall therefore have to treat of the manner of procuring the materials, of shaping them, transporting them to their place, and finally, of the construction of the edifice.

I formerly was of opinion that, during the " stone period," those who proposed to form a sepulchral chamber of considerable size were restricted to a certain extent in their choice of the site; and that it had been probably necessary to select a place where a great stone, fit for covering the chamber, already lay on the ground. I supposed that no attempt was made to raise this stone, but that a pit was dug underneath it so as to form a subterraneous chamber. Further reflection, however, has modified this opinion; and I now believe that the sepulchral chamber could have been constructed in any place whatever. Before entering into details, I shall give the reasons on which my belief is founded.

In the first place, it is by no means likely that the ancients would have been satisfied with leaving it to chance to determine the spot where a sepulchral chamber should be built. We ought, no doubt, to admit that anciently large pieces of granite existed on our plains in greater numbers than they do at present; but we must also suppose that, in very populous districts, use would soon be made of them; and, as the chambers in question were probably built near other edifices, the greater part of the masses of stone would soon be consumed. It would then become necessary to bring them from some other locality.

---

* Translated from the original.

In the second place, we often find that the sepulchral chamber has been covered by *several* over-lying stones, which appear to have been arranged in their places one after another: an arrangement which can hardly be the result of the great convulsion of the globe to which, according to geologists, we are to attribute the occurrence of great granite boulder-stones in our country.*

Thirdly, it is to be remarked, that the over-lying stones have almost always their *flat side turned downwards;* whereas, in raising great stones out of our fields, we almost always find that their uneven and rugged part is buried in the ground, a fact which is readily explained by the geological theories, and which indeed, according to them, could not be otherwise. If, then, as I have already supposed, the chamber had been constructed beneath the stone, on the spot where it was found lying, or if the stone had been raised up by means of masonry below it, the flat side of the stone would never, or at least very rarely, have been available to form the ceiling; whereas experience shows us that the case is so in almost all sepulchral chambers.

It is these observations which have chiefly led me to modify my former opinions regarding this subject, and which have induced me once more to examine the question as to the mode employed in constructing those chambers, as well as in placing the over-lying stones. I shall now offer a brief statement of the result at which I have gradually arrived by reflecting on the matter, and partly by the assistance of experiments which I made to test the correctness of my conjectures.

I. SKILL OF THE ANCIENTS IN QUARRYING LARGE MASSES OF ROCK.

I begin by establishing a principle to which certainly no one will object. I presume, then, that in every examination of antiquity it is necessary before all things to comprehend thoroughly the entire state of the epoch under consideration. Whoever undertakes to discuss any particular point in the civilization of the "stone period" ought, as far as possible, to imbue himself with the spirit of that remote time, by endeavouring to ascertain its tendency and its kind of activity, as well as what were the problems which the men of that era considered as important, and to which they devoted their minds and powers.

The name "Stone Period" is highly significant. Stone was to the men of those days what metal has come to be to us. Just as the moderns have for a long time employed all their inventive powers in procuring metals and applying them to uses formerly unknown, the men of the stone period taxed their ingenuity, physically and intellectually, in mastering the kingdom of stone, whether in moving huge masses of granite for their rude buildings, or in fashioning their finest tools from flints. They had no copper nor iron. Stone was everything to them; and the working of stone was the important problem of their lives. As one generation succeeded another, it inherited the experience and skill of its predecessors. Great difficulties, imperfect means, and the importance of the object in view, kept up the habit of acute observation, and that ingenuity and indefatigable perseverance which we have so often reason to admire among savage races. In fact there was developed amongst them a certain degree of civilization.

---

* *i.e.*, Denmark and Sweden.

The state of advancement of the stone period, with which we are now occupied, may be compared at the present day with that of those country masons of the most simple kind who undertake the cleaving of large stones, moving them from place to place, and building with them our rough massive stone fences. Their mode of proceeding is instructive. Any one who has observed attentively the work of these men, and has conversed with them on the subject of their trade, must have remarked how, without their being able to analyse their method or give reasons for it, they have managed to acquire a certain knowledge relative to the moving of large blocks of granite, cutting them, and transporting them from one place to another. They have, so to speak, got a knowledge of the inside of the stone. We hear them speaking in this manner:—"I see very well that it is on this side we must begin, or that it is on that side we must make the cut." We see them drawing a black line on the surface of the stone with a bit of charcoal, and then striking a series of blows in the direction so marked; and we are astonished to behold with what ease the most colossal stone breaks off in smooth and regular splinters under the operation. Even the most learned geologist or mineralogist would find it difficult to do the same thing. If, then, such knowledge or skill can be acquired in our days when such kinds of work are little esteemed, we can conceive how much greater it must have been in the remote period when works of stone were of primary importance for the purposes of ordinary life, and for the service of religion. It is quite certain that the men who lived during the stone period were capable, in spite of their scanty means, of producing works of stone which are now objects of our admiration. Let us look only at their arrow-points, their chisels of flint, their hatchets, &c.: no person at the present day, having merely such tools as were then in use, could form an arrow-point or a chisel like them. It would certainly be as difficult also with ancient implements to construct now-a-days sepulchral chambers like those of that period. But how does it happen that this art and skill of the ancients have been lost? Must we not seek the cause in the want of importance attached to them at the present time? When to tools of stone succeeded tools of metal, and when great sepulchral chambers were superseded by dug graves, works of stone lost their former importance, and the ancient experience in the cutting of flints, the cleaving of granite blocks, and the transporting of them without using the mechanical means we now possess, were all forgotten. It is not, therefore, in the workshop of the mechanic that we must expect to learn the method employed by the ancients in constructing their sepulchral chambers. To enlighten himself on this point, the archæologist must look to that lower class of artisans who can do their work by the simplest means.

Keeping always in view these general notions of the state of culture in the "stone period," I will now proceed to explain the method which I conceive to have been employed in building those remarkable chambers, by the use only of the simple instruments known to the men of antiquity.

II. SHAPING OF THE MATERIALS.

Whoever sets about building has to commence by collecting the necessary materials, and shaping them to answer his purpose. The builder of the Giants' Chambers must have proceeded in the same manner.

The procuring of the requisite stones could hardly have presented much difficulty in ancient times. The question was merely to find them in some place not too distant from the intended site of the sepulchral chamber, for otherwise the transporting of them would be too troublesome. Large blocks of granite were, doubtless, to be met with in considerable quantities on the plains, and particularly along the coasts where they are still so abundant. It has also been remarked that sepulchral chambers are found especially numerous near the coast, a peculiarity which some have considered to support the idea of a very early colonization of those lands. This opinion seems highly probable; for certainly the tomb would not be raised at a great distance from the habitation of the deceased and his family. However, the great number of tombs which are met with near the coasts may have been occasioned likewise by the great abundance of the blocks of stone which were accumulated in those parts, and by the difficulty of removing them to a distance. Without dwelling on this point, I shall merely call attention to it. We may always take for granted that the builder of the sepulchral chamber sought for his materials as near as possible to the place where the edifice was to be constructed.

The second step would be to shape the stone suitably for the intended purpose. If we examine the interior of a sepulchral chamber we shall see at once that the walls and ceiling always present flat surfaces, and that they form a smooth wall such as could not be produced by using the rough stones as found in the fields, or on the coast, unless with rare exceptions. There can, therefore, be no doubt that these stones were cut or shaped expressly for the work. Nor can we have any doubt that the cutting or cleaving was done on the very spot where the stones were found, since the process of shaping beforehand would diminish their size, and so lessen the labour of removing them. But we are now come to the difficult question—how was it possible to cleave such great blocks into fragments having smooth faces, by the use merely of tools made of wood or stone, which were all the means available to the men of the "stone period?" It is quite certain that they were able to do it, for we have the proof before our eyes. The question simply is, how was it done? I do not undertake to answer in a manner which will be entirely satisfactory; but I refer to the general remarks already made as to the information that an archæologist may derive from watching the proceedings of our village stone-cutters, of the simplest class. What, then, are the means these workmen employ? Water and fire, the wedge and the mallet, are their only tools. Having discovered, by a simple exercise of judgment, on which side the stone should be attacked, so as to make it split off easily into smooth fragments, they cut a groove on it in the direction they wish to cleave it: sometimes they pour water into the groove and allow it to lie there, they then surround the stone with fire, or heat it by a fire placed under it: they afterwards introduce the points of wedges (as many as they think necessary) along the groove, and strike these with their mallets. By these simple means they generally succeed in cleaving very large blocks into fragments so smooth on the face that one would imagine they had been cut by a saw.

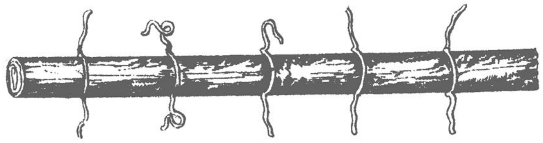
I am of opinion that the people of the "stone period" made use of some process similar to what I have just described. After having discovered by a well-practised eye at what place the stone ought to be cleft, they cut a groove in it, which they could perfectly well do with their flint tools and their stone axes: then, just as at present, they may have had recourse to water and fire; they could form their wedges of old oak, or of stones; they had likewise their wood or stone mallets; nature had, moreover, endowed them with brawny arms, strong enough to wield them vigorously.

Even in our own days, I am pretty certain that the work would be done in this same manner. How easy, then, must it have been at a period when the operation was so frequently performed, and when the work was considered as done in the service of religion. The builder of the sepulchral chamber required to have his materials all prepared, and he was able to obtain them of the kind suitable for his purpose.

III. TRANSPORTING OF THE MATERIALS TO THE GROUND.

The materials still remained on the spot where the rough blocks had been found and cloven. The next operation would be to transport the stones so prepared to the proposed site of the sepulchral chamber. This part of the work appears to us quite as difficult as the preceding, with the scanty means available in the stone period; and if the stone had to be transported a long way across rugged ground, the difficulties would, at first sight, seem to us insurmountable. I apprehend, however, that the task could be accomplished even at present, with the same scanty means; and it could be still more readily done in ancient times, when practice, skill, zeal, and perseverance in such matters must have been infinitely greater than now.

As for means, we should only require wooden wedges and levers, wooden rollers and mallets, cords made of hide, long beams or rails, and perhaps beasts of draught,—that is to say, we should only need what was in use during the "stone period." Now let us consider those means. First, as to the heavy mallet or club, the kind which is generally made of wood, and which one man can easily wield, would hardly have enough of moving power in difficult places, such as when it was necessary to raise the stone along an inclined plane, or along the land sloping upwards from the coast. Some sort of implement was required which might be impelled by the united force of a number of men. The people of old times can scarcely have been without tools of this kind: on the contrary, they must have used them, as they can be made in a most simple manner. I have in view here particularly the portable beam or ram, that is to say, a trunk of a tree tolerably straight, to which ropes of leather or hemp were fastened, by which the strength of a number of men might be applied together; it would probably be nearly of this form—



A moveable beam or ram of this kind could easily combine the force of ten men, and its effect would be considerable. As for the beast of draught, it is very possible that generally we may find no traces of the use of the horse in the tombs of the "stone period," although that animal was known very anciently in the North; but other domestic animals may have been employed, since we learn from the ancient Sagas that oxen were actually used for drawing large masses of stone. I shall give an example of this farther on.

I suppose, therefore, that the implements and tools of which we have been speaking were sufficient, in the hands of strong and robust men, to transport large stones in their cloven and prepared state, from the sea-shore, or whatever other place they were originally lying, to the spot where it was intended to erect the sepulchral chamber. By the help of wooden wedges, rams, and levers, it would be possible to raise the stone a foot, first at one end and then at the other, and to introduce below it long beams in the manner of trams or rails. As soon as the stone was resting with its flat side on these beams, it would again be raised still further by the same process: and to facilitate the moving of the weight, rollers could be inserted between the stone and the beams. Then thick leather ropes could be carried round the block, which could be drawn by the united force of men and oxen. The application of the great ram would start the mass in motion, and assist it up an ascent; and to hinder a recoil, or to allow time for rest, recourse could be had to the wedge. The rollers which were used, as they became liberated behind, could be introduced again at the front end, and so with the trams or rails.

Whatever may have been the precise plan followed by the ancients for transporting the stone, I am persuaded that it might be accomplished in the way here described, and if so, the practicability of it may be considered as established. At all events, it is difficult to approximate to the method more closely. It is evident that we are not to look for any historical accounts of that period. Nevertheless, we cannot help noticing the remarkable particulars contained in the ancient tradition given by Saxo in his *Danish Chronicle* concerning the tomb erected by Harold of the Blue Tooth over his mother, Thyre Danebod. This tradition is quite dramatic, and appears to be founded on several others which have been handed down from antiquity.

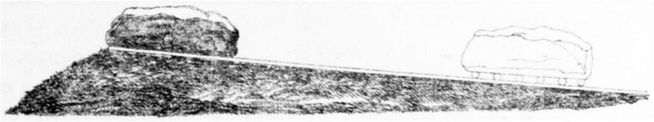
Saxo relates how King Harold had found on the shores of Jutland an enormous block of granite; and, while his rebel son Sueno was having himself proclaimed king in another part of the country, he collected a great number of men and oxen for the purpose of dragging the stone to the place where it was to be erected. In the middle of the undertaking, a man suddenly arrived, and the King, quite proud of his work, asked him if he had ever beheld so huge a mass moved by human strength. The man immediately replied: "Yes, Sire, I have seen a still larger mass drawn by human strength, for quite lately I have beheld the whole kingdom of Denmark drawn away from you. You can judge yourself which of the two masses is the heaviest." These are the very words of the tradition. We have no need to give more. We see that the large block of stone was found on the shore, that it was transported into the country, and that it was dragged by the united force of men and oxen. (In the Danish translation of Saxo by Vedel, p. 215, mention is made also of horses, but I have compared the original of Saxo, and they are not mentioned there.)

IV. ACTUAL CONSTRUCTION OF THE SEPULCHRAL CHAMBER.

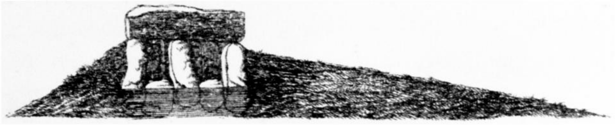
All the materials, including especially the cloven stones, having been collected by degrees, the erection of the structure itself could be commenced; that is to say, the ranging of the wall-stones in a circle, and placing on them the great over-lying stone which was to serve as a roof. This upper stone, which is usually of extraordinary size, seems to have been the part of the building which presented the greatest difficulties to the architect: it was the consideration of these which, in my former remarks, induced me to believe that the building of the sepulchral chamber must have taken place on the spot where the colossal stone was originally found, an opinion which has since been modified by the other considerations which I have already mentioned.

The erection of the sepulchral chamber could undoubtedly have been accomplished in two ways; of which, sometimes one, sometimes the other, would be preferred, according to the nature of the ground or other circumstances. Either the upper stone might be first placed, with its flat side down, at the site of the building, and then under-propped by the stones of the wall; or these latter stones might be first set up, and then the covering stone placed upon them.

It was the former of those two methods which I had in view four years ago when I communicated the observations published in the *Archæological Review* (Antiquarisk Tidsskrift) for the years 1852-54. In all essential points I still adhere to the opinions then advanced, except that I now believe the covering stone to have been transported from the place where it was found to the arbitrary spot selected for the sepulchral chamber. I presume, consequently, that, after having deposited the upper stone, with the flat side downwards, upon the building site, which was often the top of a gentle ascent, and to which it had been brought in the manner described,



the sepulchral chamber was dug underneath it, in this elevated part of the gronnd: the earth being, however, allowed to remain under the covering stone to serve as a support for it until all the wall stones were set up. This being completed, the whole of the earth was removed from beneath the stones, which thenceforward rested on the upright stones of the walls.

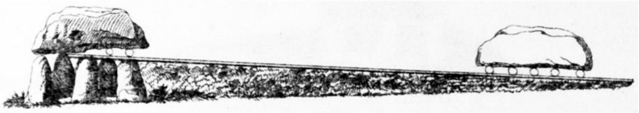


Having stopped up all the openings of the stone-work with clay and small stones, the dead body was then placed within, the entrance was closed, and the upper stone was afterwards covered with as much earth, gathered up round the sepulchral chamber, as had been necessary to remove for raising the sides or walls above the level of the field. It has frequently been noticed that chambers constructed on elevated spots are found to be depressed a yard, or even more, below the level of the ground, so that the wall-stones which support the upper stone only exceed it by a foot. I conceive that such chambers have been constructed in the manner just described.

Let us now direct our attention to the other method of construction, which was perhaps sometimes easier and more natural. The process was rather a reverse one, though leading to the same result. I suppose that the builder who followed this method first raised the stones of the wall in a circle in the open field, nearly in the manner here shown :—

The cavity enclosed had then to be filled up from above with earth or gravel, as well as the passage conducting to it, ramming down and consolidating the material, to hinder it from yielding afterwards to the weight during the work of placing the covering stone, or perhaps even several stones. It would have been necessary to raise the ground around the chamber, at least on the side at which it was intended to bring up the roof-stone, so as to form a gentle slope from the level of the field up to the top of the upright wall-stones; for the beams, along which the large stone had to be dragged, required a firm and solid foundation. The earth so collected could be used afterwards for covering up the sepulchral chamber.

The difficult work then commenced of bringing up the large roof-stone. It would be necessary to employ the same method that had been used in transporting the stone from its former position. Beams would be placed side by side on the inclined plane (which had been raised as high as the upper edge of the chamber), in such a way that the one end would project beyond the edge as much as the length of the great stone required, while the other would pass under the stone, as it was brought up; by the help of levers and wedges the block was raised a little from the beams which carried it, and rollers were introduced. The position would then be nearly as here represented:—



These preparations being finished, the raising of the stone might commence. By the assistance of wedges, levers, rams, and the strength of men and of beasts of draught, the block could be rolled up the inclined plane as far as the stones of the wall. These last being, as it were, stayed by the solid earth inside and outside of the chamber, could not shift either way; and the tram-road itself, along which the load was drawn, resting also on a solid base, would not break down. An accident of this kind could happen only when the great upper stone had entirely passed the inclined plane, and gone beyond the point of support or the edge of the wall; but even then the stone would fall into its place, and the broken ends of the beams could be removed. If the roof of the chamber required to be formed of several large stones, the same process would be repeated for each of them. The principal work being now over, what remained was easily done. The inside of the chamber was emptied of earth, and the interstices of the walls and of the roof-stones were stopped up with clay and smaller stones. The sepulchre was then ready for the reception of the corpse, and this was, no doubt, accompanied by some religious solemnity. When all was over, and the door-way closed by a stone, the whole chamber was probably covered up with the loose earth which had been employed during the operation of construction. In this manner have been formed those round and oblong tumuli which we see so frequently on our plains, and which contain within them the great sepulchres known by the name of "Giants' Chambers" (Jættestuer), whose construction we have now described in its relation to the state of civilization during the "stone period."

Though two modes of construction have been here suggested, it seems of little importance to know which of them was actually employed, as the result and the difficulties to be overcome were the same in both; it was only the order of proceeding which differed. The choice of the method would often depend on local circumstances, or even occasionally on the taste of the builder.

At all events, I conceive that sufficient evidence has been adduced to prove that, without having the advantage of the mechanical resources of modern times, and by the sole use of the implements known to our ancestors during the "stone period," it was impossible to raise those ponderous sepulchral chambers which now excite our admiration. I do not mean to deny, however, that various other methods may be imagined. If such are more reasonable or more conformable to the degree of civilization which then existed, I shall not hesitate to adopt them as the most probable.